

Claims

I claim:

1. A process for refinement of a motion estimate, comprising the steps of:
 - accepting input, wherein said input comprises:
 - a source image,
 - a target image,
 - a rectangular source block of pixels in the source image,
 - a best motion estimate of said block
from said source image to said target image,
 - a bounding box wherein said bounding box
contains said best motion estimate,
 - a best prediction error for said best motion estimate,
 - and
 - a depth bound to limit the precision of the refinement;
 - subdividing said bounding box to obtain a plurality of child bounding boxes,
with a child motion estimate for each of said child bounding boxes;
 - evaluating said child motion estimate for each of said child bounding boxes
to obtain a child prediction error for each of said child bounding boxes;
 - selecting from said evaluations of said child bounding boxes
a best child bounding box, a best child motion estimate,
and a best child prediction error;
 - optionally, according to whether said depth bound is greater than zero,
recursively refining said best child bounding box using
said source image,
said target image,

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said source block,
 said best child motion estimate,
 said best child bounding box,
 said best child prediction error,
 and
 said depth bound less one;
optionally, according to whether said best child prediction error is smaller
than said best prediction error,
resetting
 said best prediction error
 and
 said best motion estimate
to
 said best child prediction error
 and
 said best child motion estimate,
respectively;
and
providing output, wherein said output comprises
 said best prediction error and said best motion estimate.

2. The process of Claim 1,

 wherein said subdivision step uses a quadtree subdivision
 providing four child bounding boxes.

3. The process of Claim 1,

 wherein said child motion estimate for each of the said child bounding boxes

is the center of said child bounding box.

4. The process of Claim 1,

wherein said evaluation step for each of said child bounding boxes

is a process comprising the steps of:

texture mapping of a rectangular region in said target image,

said rectangular region of size equal to said source block,

and

said rectangular region displaced translationally

from the position of said source block

according to said child motion estimate for said child bounding box,

wherein said texture mapping provides a prediction block

comprising a rectangular block of pixels

of equal size to said source block;

and

computation of said child prediction error using

a pixel-wise metric between said source block and said prediction block.

5. The process of Claim 4,

wherein said pixel-wise metric is the L^1 metric, that is,

the average of the absolute differences

between said source block and said prediction block

on a pixel by pixel basis.

6. The process of Claim 4,

wherein said pixel-wise metric is the L^2 metric, that is,

the square root of the average of the squared differences

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between said source block and said prediction block
on a pixel by pixel basis.

7. The process of Claim 4,

wherein said pixel-wise metric is the L^∞ metric, that is,
the maximum of absolute differences
between said source block and said prediction block
on a pixel by pixel basis.

8. A process for refinement of an initial motion estimate

for a block of pixels between a source and a target image,
comprising the steps of:
generating a succession of trial motion estimates;
predicting said block of pixels for each of said trial motion estimates
by texture mapping from the target image
according to each trial motion estimate;
evaluating each of said predictions using a supplied pixel-by-pixel
metric to provide a measure of error;
and
selecting that trial motion estimate
from said succession of trial motion estimates
which minimizes said measure of error.

9. The process of claim 8, wherein

an initial bounding box is selected
such that the center of said initial bounding box
is said initial motion estimate;

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and

said succession of trial motion estimates is obtained
by selection of the centers of bounding boxes obtained
by recursive quad-tree subdivision of the initial bounding box.

10. The process of claim 9, wherein said initial bounding box
is selected to have a dimensions of 1x1 pixels.

11. The process of claim 9, wherein
said quad-tree recursive subdivision of bounding boxes is restricted
to the particular bounding box at each recursive step
which minimizes said measure of error
obtained by said prediction and said evaluation
of the trial motion estimate associated with each successive bounding box.

12. The process of claim 8, wherein
the prediction step consists of texture mapping
a region of size equal to said block of pixels from said target image
where said region in said target image
is displaced from the position of said block of pixels in said source image
by translation according to said trial motion estimate.

13. The process of claim 8, wherein
said measure of error in said evaluation step
is the L^1 metric, that is,
the average of the absolute differences
between said source block and said prediction block

2025 RELEASE UNDER E.O. 14176

on a pixel by pixel basis.

14. The process of claim 8, wherein

said measure of error in said evaluation step

is the L^2 metric, that is,

the square root of the average of the squared differences

between said source block and said prediction block

on a pixel by pixel basis.

15. The process of claim 8, wherein

said measure of error in said evaluation step

is the L^∞ metric, that is,

the maximum of absolute differences

between said source block and said prediction block

on a pixel by pixel basis.

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